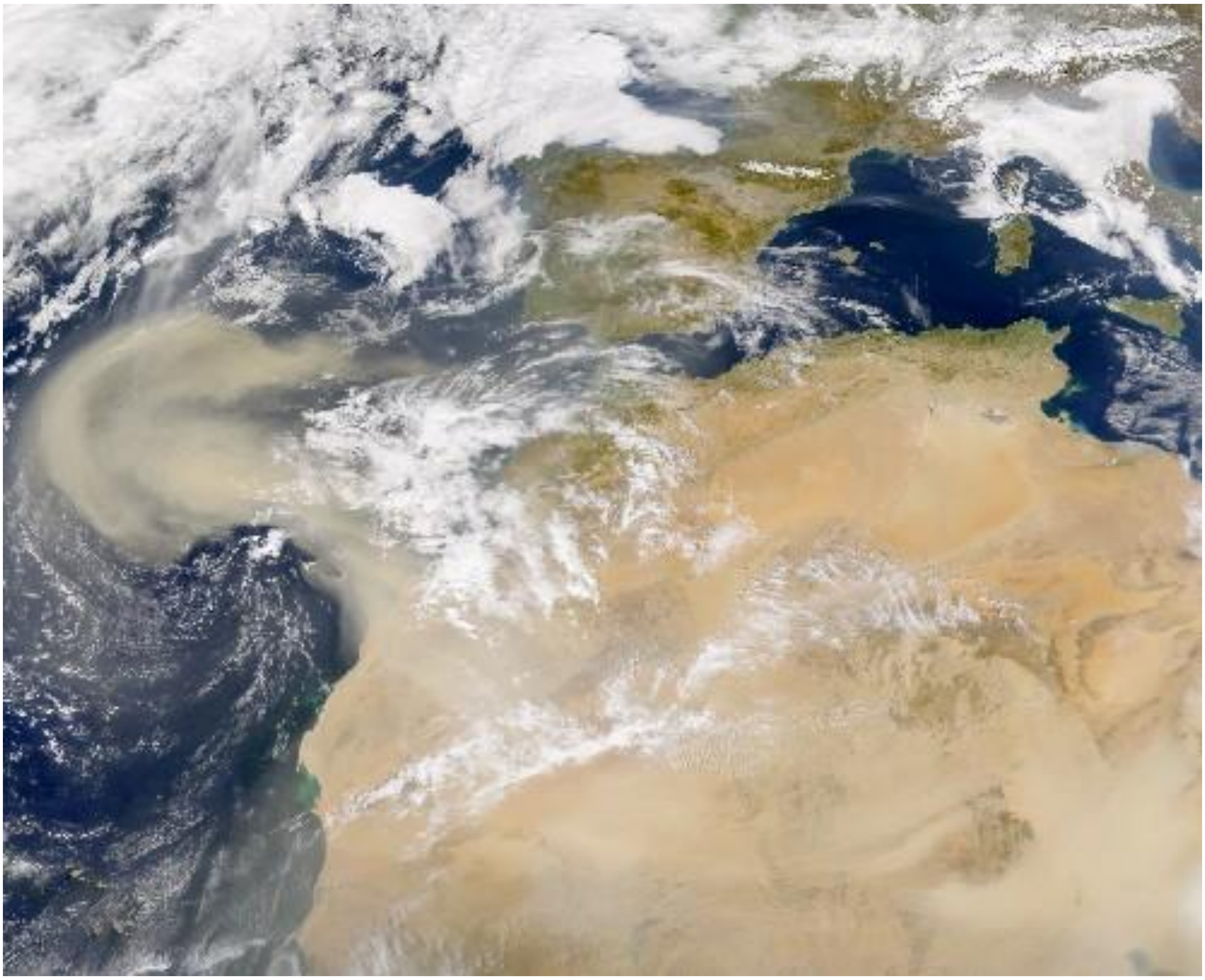
SCIENCE FOCUS: SAHARA DUST

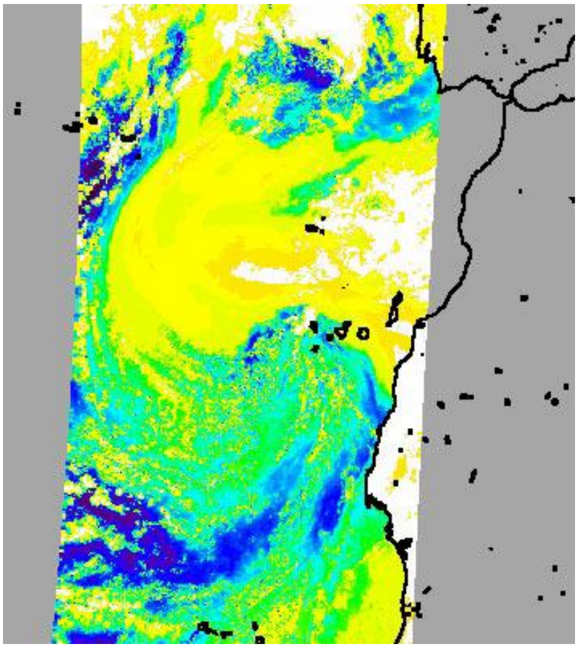
SeaWiFS: Dust to Dust

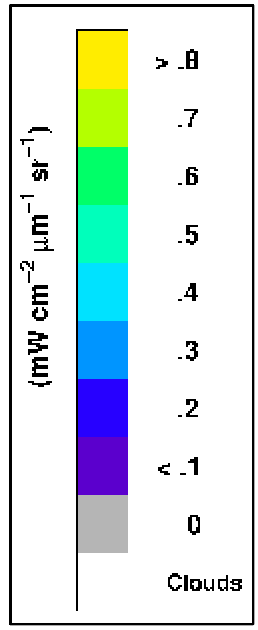


The north Atlantic Ocean borders one of the most active arid and semi-arid regions in the world: the northwest African continent, home of the Sahara and Sahel deserts and source of the majority of dust storms that are frequently transported aloft for many thousands of miles across the tropical Atlantic. The most intense dust storm activity is generally considered to occur from late spring to late summer. However, dust outbreaks can also take place during the non-dusty season, such as was the case on February 26, 2000 (image above). SeaWiFS captured this massive dust cloud and monitored its spatial and temporal evolution as it moved over the Atlantic Ocean (next page). Most of the dust was carried southwestward toward South America, but a portion of the dust cloud was transported northward toward Britain and eventually toward the east coast of the United States.

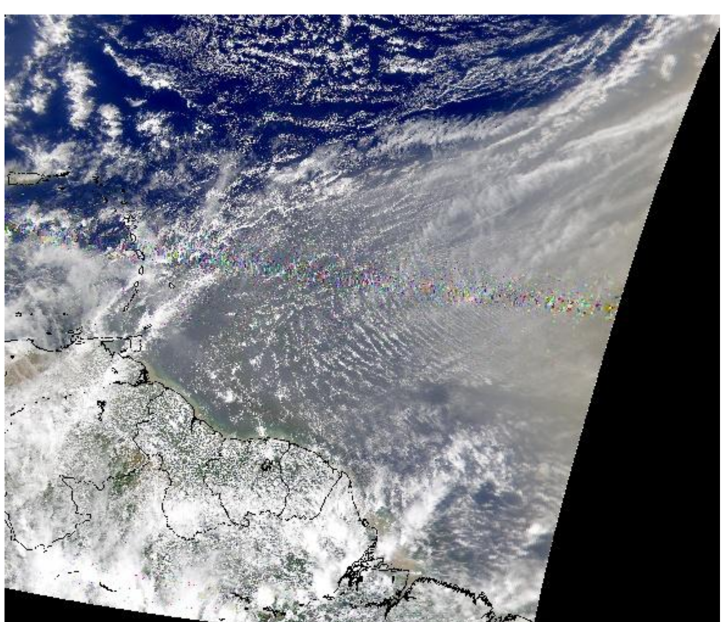
SeaWiFS hemispheric image of scanning swaths acquired on February 28, 2000, two days after the image on the first page. Transport of the dust from the storm over the Atlantic Ocean is visible. The long dark vertical gaps are the spaces between the scanning swaths; the small dark horizontal gaps are the tilt segment.

The figure below shows the aerosol radiance at 865 nm for the same dust storm. A partial cloud mask (white) has been applied. The color palette shows the corresponding radiance values.





On March 11 the dust in this dust plume reached the northeastern coast of South America. The image below was acquired at the HRPT receiving station at the University of Puerto Rico in Mayaguez. The bright specks of color that can be seen in this image (about halfway down) are due to brief loss of signal from the spacecraft while the data was being acquired. The curved edges are the boundaries of the SeaWiFS scanning range. Country borders and the coastline have been mapped on this image.



Dust particles from such plumes are one type of "natural" component (other components are sea salt and volcanic ash) that comprise atmospheric aerosols. The other constituents are primarily anthropogenic in nature, and are ejected into the atmosphere as a result of fossil fuel combustion or biomass burning. Aerosols in general, and dust in particular, are of growing concern because of their potential influence on climate. As dust can both directly (by absorbing and scattering solar radiation) and indirectly (by altering cloud properties) affect climate, global coverage monitoring the intensities of dust storms and their spatial/temporal patterns is of great interest.

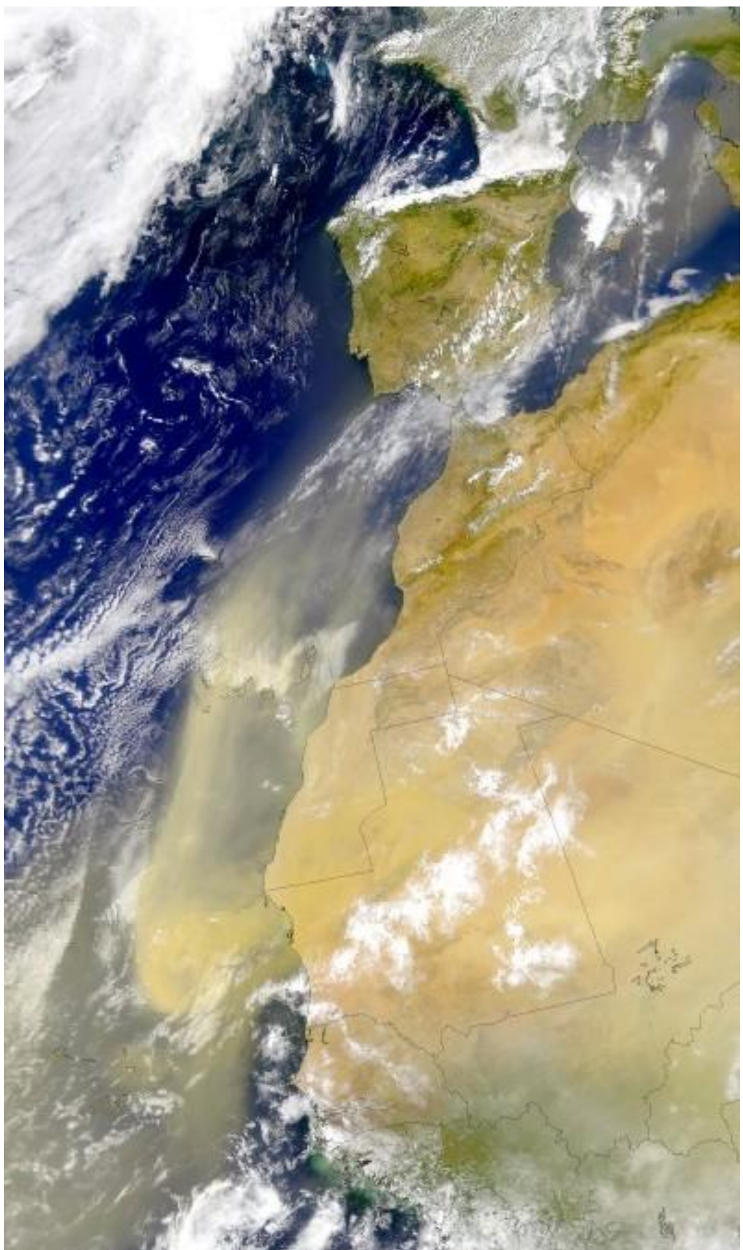
There are several other reasons to study aeolian events such as these. One reason is that dust particles, which are derived from the Earth's crust, can contain elements such as iron which are known to be the limiting micronutrient to phytoplankton growth in some parts of the world's open ocean regions. Although the Atlantic Ocean is generally not considered to be iron-limited, uptake of iron by surface-residing phytoplankton can result in increased rates of carbon dioxide assimilation, which in turn may result in climate change effects.

Aeolian aerosols may also be viewed as a transport vehicle by which other substances are carried long distances. For example, pollution products, pathogens, or agronomical pests can be brought from one part of the world to another, all within a matter of a few days. The increased appearance of certain diseases has raised the question of a possible link to alterations in climate such as prolonged periods of rainfall or drought, according to reseearch performed at the Harvard Medical School Center for Health and the Global Environment. Also, studies are underway to test the hypothesis that dust storms emanating from the African continent and crossing the Atlantic may in fact carry pathogens or other substances that are responsible for the demise of some coral reefs in the Caribbean (USGS Center for Coastal Geology). There may even be a connection between dust storm activity in the Sahel and hurricane intensity in the Atlantic, but this connection is difficult to prove due to the intrinsic variability of hurricanes.

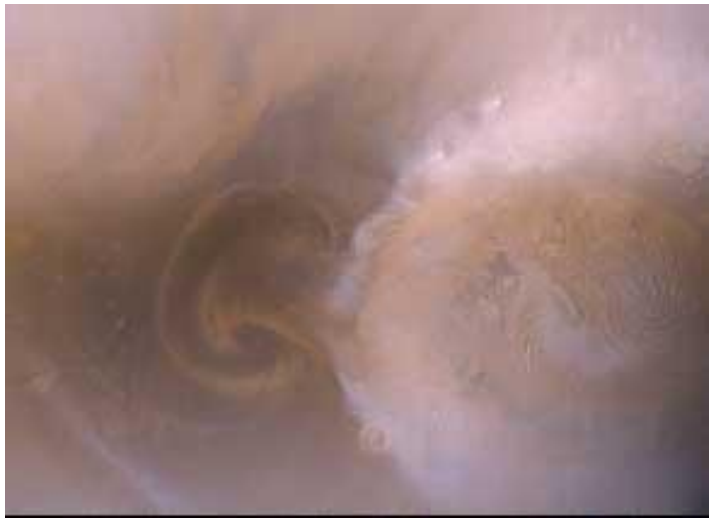
Although the main mission of SeaWiFS was to observe ocean color, the sensor was also capable of monitoring large-scale dust and pollution plumes on a global scale, thus providing a platform from which ocean-atmosphere interactions could be studied.

More images:

Saharan dust outbreak over the Canary Islands observed on June 22, 1998. On the following day, atmospheric dust collectors located at Izaña on the island of Tenerife recorded the highest dust load ever measured up to that date.



The Mars Global Surveyor captured an image of a dust storm off of the northern polar cap on August 29, 2000. The shape of this Martian dust storm is remarkably similar to the shape of the Saharan dust storm observed by SeaWiFS on February 26, 2000.



Text and images contributed by Dr. Petra Stegmann, University of Rhode Island Graduate School of Oceanography. Additional images provided by Norman Kuring, SeaWiFS Project, NASA Goddard Space Flight Center, and Malin Space Science Systems.

Related Links

- University of Rhode Island Graduate School of Oceanography
- Mars Global Surveyor
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